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A NEW AMANITA FROM ARKANSAS

H. R. ROSEN

(WITH PLATES 9–11)

Amanita arkansana sp. nov.

Pileus 10–15 cm. broad, occasionally considerably larger, at first conical or hemispherical, later convex to expanded, very slight if any viscidity, orange-buff to baryta-yellow (Ridgway), usually lemon-yellow at the margin and deeper yellow above, never red, or orange-red, older or dried specimens are mostly tan colored with faint tinges of yellow, glabrous, rarely with 1 or more large whitish patches, remnants of the universal veil, margin conspicuously striate, the striations extending 2–4 cm. from margin. *Gills* adnexed by a line, the line usually extending 1 or 2 cm. down the stem, yellow at first, particularly on the edges and near the flesh, gradually fading to creamy white or whitish, 1–1.5 cm. broad at the widest point, this being somewhat closer to the margin than to the apex. *Stem* 10–15 cm. long, 1.5–3.0 cm. thick, usually stout, slightly thicker in the region of the volva, glabrous below and usually with irregular patches or fibrils on the upper half, stuffed with soft, cottony material at first, then hollow, yellow, the fibrils becoming darker yellow when handled. *Annulus* superior, attached about 1 cm. below the top of the stem, yellow, large, up to 4 cm. long, pendant, membranous. *Volva* white, firm, very thick below, often as much as 1 cm., thinner toward the entire margin, consisting usually of the whole of the universal veil, quite fleshy even at the margin (see PLATE 9), forming a fair sized cup, the ample free margin of which is always free from the stem when young and usually so at maturity, mostly 3–6 cm. long (1 specimen found with a volva 11 cm. long, PLATE 9). *Spores* broadly ellipsoid or ovoid,

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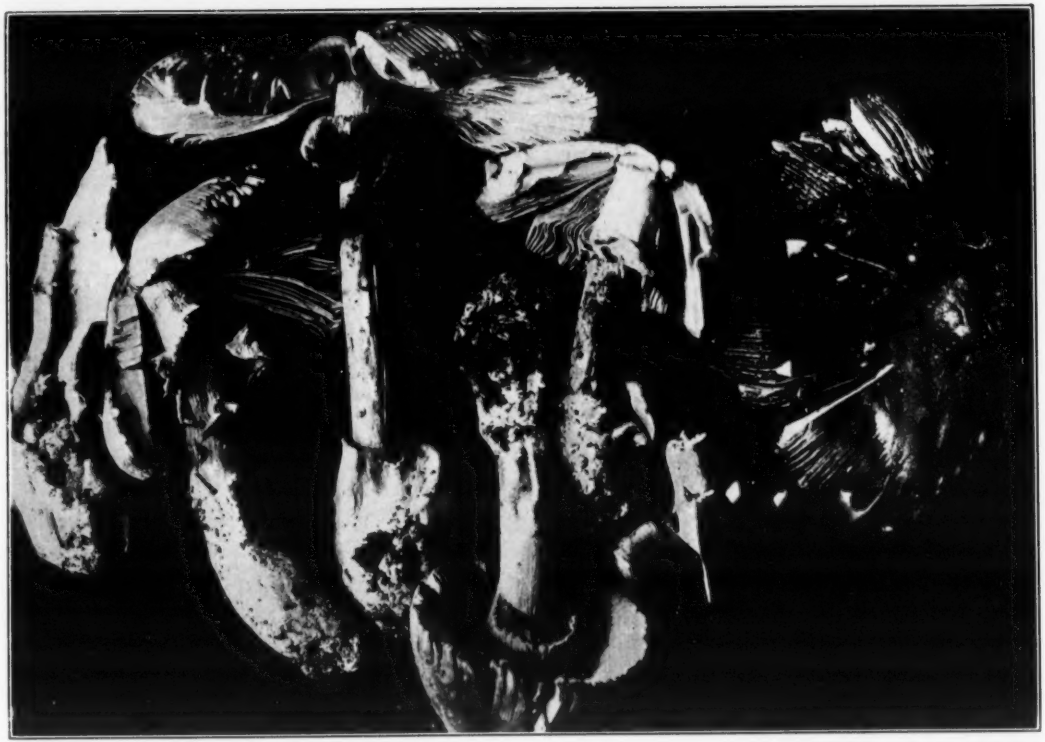
frequently with an apiculus irregularly disposed, often with a single large guttula, or granular, 7.5–10 × 7–8 μ exclusive of apiculus. Odor mild, somewhat sweetish.

Solitary or scattered gregarious, occasionally in troops. On the ground in frondose woods. Very abundant in region east of Fayetteville, Arkansas, during a rainy spell in first part of October, 1925.

This large, beautiful mushroom was first called to my attention by Dr. G. E. Hastings of the English Department, University of Arkansas. He brought in the monster shown in PLATE 9. As the specimen when first seen was not fully developed, identification was rather difficult. Even after a period of 4 days, during which the pileus had considerably expanded, identity of the fungus remained uncertain. Not a sign of a gill was to be seen, the under surface of the pileus being covered with a heavy coating of tissue, the partial veil. This, in addition to sheathing the gills at the margin of the pileus, extended upward along the gill surface, clothed with irregular extensions, homologous to similar particles on the upper part of the stem. Finally, this whole inner or partial veil ruptured, becoming a large, pendant annulus. I at first considered this as an abnormally large *Amanita Caesaria*, which was off color. It had the yellow gills, the striate margin of the pileus, and other features connected with the emperor mushroom.

The discovery by the writer of an amazingly large number of the same species several days after the finding of the first specimen finally convinced me that this was not *A. Caesaria*. On this trip, October 13, I also collected large numbers of the true emperor mushroom, although this is the first time I have seen it in Arkansas. It was noted that wherever the yellow colored form appeared all the pilei possessed the same color, and wherever a red one was found, if any others appeared they likewise were red. Several times good-sized troops, consisting of 6 to 12 carpophores, of both kinds, were found in close proximity, the troop of each kind always showing but one color with no gradations. Occasionally, when examining a group, I found hidden below the fallen leaves young forms which were just beginning to break through the universal veil and these also showed the brilliant red or the bright yellow, according to the color of the

AMANITA ARKANSANA



AMANITA CAESARIA

adjoining specimens. Obviously this difference in color is not due to difference in habitat or in stage of development.

A careful study of the 2 forms revealed other differences. The volva is larger and notably more fleshy in the yellow form (see PLATE 9). The gills while similar in young specimens are whiter, some being snow white, in older specimens of the yellow form. The annulus is more ample and not as delicate (see PLATES 10 AND 11). The spores are somewhat smaller, those of the yellow form average 8.5 × 7 μ, while those of *A. Caesaria* gathered at the same time and of comparable development average 10.5 × 7 μ. (Coker's measurements of *A. Caesaria*, Jour. Elisha Mitchell Sci. Soc. **33**: 19. 1917, are somewhat large for average spores. My figures agree well with Murrill's N. Am. Fl. **10**: 69. 1914.)

While these were gathered in October, there is a strong possibility that it is ordinarily a summer mushroom. The reason why I suspect this is that I gathered at the same time *A. Caesaria*, which is usually considered a summer form, and I also found in considerable abundance *A. phalloides* and *A. rubescens*, both of which I usually find in early summer in this region. The very dry summer of 1925 evidently had something to do with this.

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EXPLANATION OF PLATES

PLATE 9. An abnormally large *Amanita arkansana*, with a volva measuring 11 cm. in length, and the whole carpophore attaining a height of about 20 cm. Reduced to about ¾ natural size.

PLATE 10. *A. arkansana* showing the large pendant annulus on several specimens. For details of volva see FIG. 1. Reduced to about ½ natural size.

PLATE 11. *A. Caesaria* showing size and nature of volva and annulus. Reduced to about ½ natural size.

THE DEVELOPMENT OF THE PERITHECIA IN THE MICROTHYRIACEAE AND A COMPARISON WITH MELIOLA

RUTH WINIFRED RYAN

(WITH PLATES 12–15)

In recent years many advances have been made in the taxonomy of the fungi. Perhaps in no one group has there occurred as many changes as in the Microthyriaceae. Under the leadership of von Höhnel the entire bases of the family became subject to critical investigation followed by a complete revolution of the classification.

The family was placed among the Dothideales by Saccardo (**9**) in 1883. Since then it has been described as belonging to the Perisporiales. Atkinson (**2**), however, considered that they have little in common with this order. He believed that the Microthyriaceae represent reduced forms derived on the one hand from the Phacidiales and, perhaps, on the other from the Sphaeriales. He did not say definitely, though, where they do belong. Theissen and Sydow (**15**) placed the family in a new order, the Hemispheriales, which they created for genera having a superficial, halbert- to shield-shaped perithecium. Miss Doidge (**4**) accepts this classification in her systematic work. According to Arnaud (**1**) the family belongs to the Pyrenomycetes, because, he says, the asci are localized in particular zones formed by the gelatinization of the sterile cells of the cavity. The Microthyriaceae would thereby be near neighbors of the Myriangiaceae. In my taxonomic study of the Microthyriaceae of Porto Rico (**8**) and Hawaii (**10**), I used the classification given by Theissen and Sydow. The Microthyriaceae seem to me more closely related to the Hemisphaeriales than to the other groups with which the family had formerly been placed.

The first description for the family is given by Saccardo (**9**). Translated, it reads "simple perithecia superficial, black, membranous to carbonaceous, dimidiate, flattened; context nearly

always radiate." This description is accurate. The characters are firmly established and easily recognizable.

The various genera of the family can be placed in two groups according to Theissen (**12**) and Arnaud (**1**), those having a free mycelium and those in which it is lacking. The present paper deals with the development of the perithecia in the eleven genera that have a superficial mycelium. The material for study was obtained from the herbarium of the University of Illinois from collections made by Dr. F. L. Stevens in Porto Rico, Hawaii, and British Guiana.

The mycelium in all the eleven genera plays an essential role in the development of the perithecium. Its characteristics are well determined and hereditarily fixed. It is brown, cylindrical, septate, tough and may or may not bear hyphopodia or nodulate cells. These last two structures also play a part in the formation of the perithecium.

Formerly it was thought that the hyphopodia when they occurred on the mycelium of fungi might be sexual organs. This was at first supposed to be the case in *Meliola*. Ward (**17**) in studying this genus suggested that the hyphopodia were such. More recently Thaxter (**11**) has compared them to the antheridia of the Laboulbeniales. Arnaud (**1**) is of the opinion that they do not function as sexual organs and that they are merely the rudiments of the perithecia and absorptive organs. Investigations by Maire (**6**) show that the hyphopodia in *Meliola* function as organs of absorption and attachment. Cytological studies by Arnaud (**1**) seem to indicate that the same relation to the host tissue exists in the Microthyriaceae.

Arnaud includes *Meliola* in his study of the Asterinées (**1**). To me they seem fundamentally different as portrayed in their development. For this reason I have placed them in the Perisporiaceae as does Beeli (**3**).

The hyphopodia in *Meliola* are two-celled, while they are either one- or two-celled in the Microthyriaceae. In the Microthyriaceae and in *Meliola* they may be opposite or alternate, the majority being the latter. Often one finds several hyphopodia arranged on one side of the mycelium, while further on in the same filament they will be either opposite or alternate. The

characteristic arrangement of the structure may be used as an aid in classification.

The formation of the perithecium in the majority of ascomycetes results from the activity of sexual organs, which have the power of conjugation. This fusion then is the point of development of the perithecium. In *Meliola* (**17**) the hyphopodia substitute for these organs. Those that give rise to perithecia have a reflexed swollen end and produce the fruiting structures through proliferation. In the Microthyriaceae the hyphopodia though not sexual organs give rise to the perithecia in certain cases. This family advances further, for here the perithecia may arise independently of the hyphopodia, that is, from the mycelial cells themselves. This method of origin seems to be by far the most common.

A search through mycological literature revealed only a few articles which bear in any way on the development of these fungi. Gaillard (**5**) studied a few species of *Asterina*. He says that the summit of the hyphopodium turns toward the leaf. This small cell divides, at the same time becoming clearer. The primitive membrane becomes thinner, budding in places and appearing as a small lenticular body closely applied against the leaf. Its surface is covered by deep lobes, which in growing seem to radiate around a point, which is the place of insertion on the mycelium of the primitive hyphopodium. In the majority of cases the hyphopodia do not participate alone in the division, but the portion of the mycelium where it is inserted also takes an active part. Thus he indicates one method of development characteristic of the genus and of the family as a whole.

Raciborski (**7**) refers to the subject only in passing, saying that the perithecia are borne laterally on the hyphae as in *Balladyna*, *Aldona*, *Dimerosporium*, or *Meliola*, and that they grow conical and broaden against the leaf. Miss Doidge (**4**) briefly gives two methods; from a medial cell of a hypha and from the terminal cell of a short lateral branch. She does not go into any detail.

Theissen (**13**) says that divisions in the hyphae give rise to irregular cells by the insertion of several cross walls. The perithecium arises on the lower surface of the hyphae. A small

knot of cells is formed and is the base of the perithecium, which continues to grow radially and centrifugally to a disk-shaped structure. The radial walls remain locked together. New radial walls become inserted so that the disk shape is maintained.

Arnaud (1) thinks that the fertile stroma arises by the proliferation of a cell or a small number of cells which put out filaments extending radially on the cuticle of the host, and which fork enough to form a continuous bed. These proliferations constitute a regular radiate disk. As this plate becomes thickened on its inferior face, the superior face conserves on all its extent the radiate structure.

Von Höhnel (16) states that the shield-shaped structure is merely a protective cover for the independent perithecia which develop inversely beneath it.

Raciborski (7) was the first, however, to state that the perithecia were inverse. Theissen, Miss Doidge, Arnaud, and von Höhnel have accepted his statement as being correct. By inverse, one understands the perithecia to be fastened on the under side of the hypha. The oldest or basal part therefore is above the newest or marginal part of the fruiting body. Von Höhnel also pointed out that the asci arise from the part of the perithecium pressed against the leaf, or from the youngest and the top part of the structure. The asci are, therefore, inverted in the perithecium, but are borne upright on the surface of the leaf. This meaning of the term inverse has been used in this discussion.

As I have stated previously, in *Meliola* the fructifications are always derived from hyphopodia, while in the Microthyriaceae in certain instances the perithecia are formed from the hyphopodium; in other instances from the cells of the mycelium. This latter method is characteristic of species which have a non-hyphopodiate mycelium, but which form as many fructifications as the others.

The origin directly from the mycelium predominates throughout all the genera of the family. Out of the ninety-four species studied eighty-four show this method of development.

Portions of the mycelium were fixed in cellodin, mounted and studied under oil immersion. The mycelium sometimes was slightly swollen in regions where a perithecium was developing.

At other times it remained normal. In either case, however, cross septa appeared, giving rise to one or more small cells. Rarely does the number exceed five. These cells are nearly square in shape, otherwise showing no differentiation from the rest of the mycelium. They all seem to function alike in the formation of the perithecium (PLATE 12, FIG. 8).

They give rise to bud-like growths (PLATE 12, FIG. 4). These budded cells are irregular in outline, often distinctly lobed on their free margins. They may occur on both lateral margins of the mycelium. The budded cells likewise divide increasing the number of cells centrifugally. These cells are united to one another so that a disk-like structure is produced (PLATE 12, FIG. 6). Further cells are added to the structure until finally the maximum growth of the perithecium is reached. The walls of these cells are thick and dark. There may be more than one layer of them. Cross sections of the perithecium generally show at least two.

The second method of origin is from hyphopodia which are one- to two-celled structures located on the lateral margins of the mycelium. If the hyphopodium has only one cell, this cell buds several times (PLATE 14, FIG. 43). The budded cells in turn proliferate, the new cells being laid down in rows (PLATE 14, FIG. 43). This process continues until the maximum growth has been reached. The radiate structure can be observed after several rows of cells have been formed.

If the hyphopodium is a two-celled structure, the terminal cell only participates in the formation of the perithecium. This cell buds in the same manner as does the one-celled hyphopodium. In both kinds of hyphopodial development, as well as in the development from the mycelium, the perithecium produced is always inverse at maturity.

A third type of development is from short lateral branches. This method is less common; only six species of all those investigated show this method of origin. The lateral branch of the mycelium, consisting of one to three cells, is ordinarily borne at an acute angle (PLATE 12, FIG. 14). The terminal cell in all cases is the one that functions in the production of the fruiting structure. This cell buds in a manner like that of the terminal

cell of the hyphopodium. *Asterina Gouldiae* is a typical example of this mode.

Only two species having nodulate cells in the mycelium were studied. These were *Asterina inaequalis* var. *nodulosa* (PLATE 12, FIG. 13) and *Asterina Schroeteri* (PLATE 13, FIG. 15). In both these forms the perithecium did not develop from the nodulate cell, but from an undifferentiated cell of the mycelium. The manner of growth was like that already described in the first method.

Gaillard (**13**) gives illustrations of *Asterina stricta* which has nodulate cells that develop into the perithecia. This would indicate that there were two ways of producing a perithecium in the species which possess this kind of a mycelium. A further study of other species with a like mycelium would be interesting and would enable one to form a more accurate idea of the true method of origin in these species.

In all the genera after the disk has reached its specific extension the radial growth is halted. The central part has meanwhile swollen from the middle of the perithecial hollow, while the peripheral growth remains close to the leaf. The result is a concave perithecium, which is only half a one in reality and is developed below the mycelium.

The preceding description of the development of the perithecium can be applied to all the genera, for even those having oblong perithecia at maturity are at first circular. The elongate character is due to the more rapid growth of the perithecium on two opposite points on the disk. Frequently a three-angled perithecium is observed. This seems to be the result of growth at three points on the disk instead of at two.

Contrasted to these various methods of origin, the perithecia in *Meliola* exhibit an unexpected constancy. In the forty species studied, all showed origin from the hyphopodia. Furthermore, the method of development observed agreed in detail with that reported by Marshall Ward (**17**). A brief summary is given here.

The simple pyriform body, the hyphopodium, after becoming swollen, suffers division into two portions or cells by a septum, usually vertically to the plane of the mycelium and leaf, and passing diagonally across the cavity with a slight curve so as to

abut on the outer walls at right angles, or nearly so. The original unicellular protuberance becomes in this manner divided into two more or less unequal cells which have different destinies. The more apical cell divides more slowly and forms a mass of cells, the central ascogenous tissue, of the young perithecium. The outer cell divides much more rapidly, producing a layer of cells which gradually develops the thin-walled cells of the outer portion of the perithecium. These thin-walled cells make the ascogonium. In later stages, according to Ward, certain of the constituents are seen to form asci and spores, while others deliquesce and serve as nutritive material. The outer walls, as in the Microthyriaceae, become thick, hard, and dark colored. The perithecium in *Meliola* is always produced from the upper side of the mycelium so that it is never inverse (PLATE 15, FIG. 1) and is always spherical or approximately so.

While this method of development holds for the majority of the species of *Meliola*, there are six species which show more distinct relationship to the Microthyriaceae. Beeli in his monograph of the genus *Meliola* (**3**) makes a division on the character of the radiate and pseudoparenchymatous tissue, placing the six species referred to in one group. He seems to have either overlooked the previous work of Theissen on *Meliola* (**14**) or to have rejected it.

Theissen studied specimens of *Meliola asterinoides* and created for it a new genus, *Amazonia*, which he placed in the Microthyriaceae because of its radiate inverse perithecia. In studying material labeled *Meliola Psychotriae*, one of the other five species in this group, I have found that the development of the fruiting body approximates the development of the perithecium in the Microthyriaceae. The origin is from the hyphopodium, which proliferates in the manner already described for the hyphopodial origin in the Microthyriaceae. There is no definitely arranged method of division, as in *Meliola*, for the cells formed may or may not be of the same size. Furthermore, there may be more than two cells produced. In any circumstance the cells do not seem to form definite regions of the perithecium as in *Meliola* (PLATE 12, FIG. 7). At maturity or during the latter part of growth, the fruiting structure is inverse and radiate, thus differing

in two essential characters from *Meliola*. For these reasons I have followed Theissen's classification and placed the fungus in the genus *Amazonia*.

Meliola Laguncullariae, like the foregoing species, is also inverse radiate (PLATE 15, FIG. 15). The method of development of the perithecium is like that described above. Therefore, this species should also be placed in the genus *Amazonia* as **Amazonia Laguncullariae** comb. nov.

I did not study the other species listed by Beeli in his first division, but in all probability they will show the same characters as the two foregoing species and, therefore, will be placed in the same genus.

In some of the Microthyriaceae an ostiole-like opening appears. This is not an "ostiole" in the true sense of the word. It appears at maturity and is due to the gelatinization or cracking of the central cells around the point of insertion on the mycelium or hyphopodium. The region where this occurs is the oldest and basal portion of the perithecium, and not the youngest and top part as one would ordinarily expect. There is evidently no precise method of development for the "ostiole." When the perithecium is round the opening may be circular with ragged edges, due to the loss of several of the central cells (PLATE 14, FIG. 40), or it may be stellar, due to the severance of some of the cells along the lateral walls (PLATE 14, FIG. 33). Frequently these fissures extend almost to the margin of the perithecium. Or the entire central region of the perithecium may become gelatinous and disappear, leaving the asci fully exposed.

In genera where the perithecia are oblong in shape, the "ostiole" follows the shape of the fruiting structure. It may remain narrow, so that it is thread-like in appearance, or it may become greatly widened, in which case the asci are exposed. In these oblong perithecia the lenticular "ostiole" may become stellar at its ends.

"Ostioles," however, do not occur in all the species before they reach maturity. Before the dispersal of the spores can take place though, the shield-like structure must be ruptured or become disintegrated. In *Meliola*, the rupturing of the perithecium occurs in the youngest and the top part of the peri-

thecium. This is diametrically opposed to that of the Microthyriaceae. In *Amazonia Psychotriae* the "ostiole" is like that of the family to which it belongs.

The typical young fruiting body in the Microthyriaceae is always light brown in color. The radiate cell structure is apparent. On maturity it often becomes a dark brown, darker than the mycelium. The margin, though, remains lighter in color and the radiate character persists. At times, though, the radiate structure is not apparent, until the material has been boiled in potassium hydroxide, or a young specimen has been observed. When the first cells of the perithecium are laid, they ordinarily are arranged in a row. The next cells also occur in a row, and it is not until then that the perithecium begins to look radiate. On maturity, too, this character may be nearly obscured. In some genera the central cells gelatinize, so that only the marginal cells remain intact. These, however, always show the character. Other genera have perithecia which become almost wholly carbonaceous. But in such cases the margin again gives the character.

SUMMARY

The Microthyriaceae show four characteristic ways of developing the perithecia. The methods are: from a cell of the mycelium; from hyphopodia; from the short lateral branch; from a nodulate cell. The most common way is from a cell of the mycelium.

The perithecia are flattened.

In early stages the fruiting structure is radiate. This character later may be lost due to the perithecia losing its top through becoming gelatinous or carbonaceous. However, at all times the edge of the structure will show the character.

The perithecia are all inverse, that is, they are borne on the lower surface of the mycelium.

At maturity the perithecia break open, thus permitting the spores to escape. Often, however, an "ostiolar" opening appears at the base of the perithecium. This may be round, stellar, or linear in shape.

In *Meliola* the perithecia always arise from hyphopodia.

The perithecia are more or less round, never flattened. They never show the radiate character at maturity, although a few species may do so when very young.

The perithecia are never inverse, but are always borne on the upper surface of the hyphopodium.

Meliola Psychotriae is radiate and inverse as is also *Meliola Laguncullariae;* they, therefore, belong to the genus *Amazonia.*

An undetermined perisporiaceous form also showed the radiate perithecia and so rightfully belongs to Microthyriaceae.

The following table lists the genera of the Microthyriaceae examined in this study. Hypho. stands for hyphopodia; myc., mycelium; lat. br., lateral branch; nod., nodulate cell.

Genus	Method of Development				Ostiole		
	Myc.	Hypho.	Lat. Br.	Nod.	Linear	Stellar	Round
Asterina	35	3	2	2	7	7	11
Asterinella	6	1	1			4	7
Amazonia		1	1				1
Aulographum	1				1	1	
Calothyriopeltis	3					1	
Echidnodes	3				3		
Echidnodella	5				5		
Englerulaster	2		1				3
Lembosia	10				10		
Morenoella	16				16		
Questieria	1		1				3

	Method of Development				Perithecia			
			Hypho.		Inv.	Not Inv.	Rad.	Not Rad.
Meliola			40		2	38	4	36

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EXPLANATION OF PLATES

All figures were drawn from material mounted in celloidin and drawn with the aid of a Spencer camera lucida, and were reduced one half in reproduction. PLATES 12 to 15 show stages in the development of the perithecia in the various species studied.

PLATE 12

Fig. 1, *Morenoella decalvans* var. *Stigmatophylli;* 2, *M. Calami;* 3, *Asterinella multilobata;* 4, *A. Hippeastri;* 5, *A. Ixorae;* 6, *A. Phoradendri;* 7, *Amazonia Psychotriae;* 8, *Calothyriopeltis Scaevolae;* 9, *Lembosia Sclerolobii;* 10, *L. Coccolobae;* 11, *L. ananensis;* 12, *L. portoricensis;* 13, *Asterina inaequalis* var. *nodulosa;* 14, *A. Gouldiae.*

PLATE 13

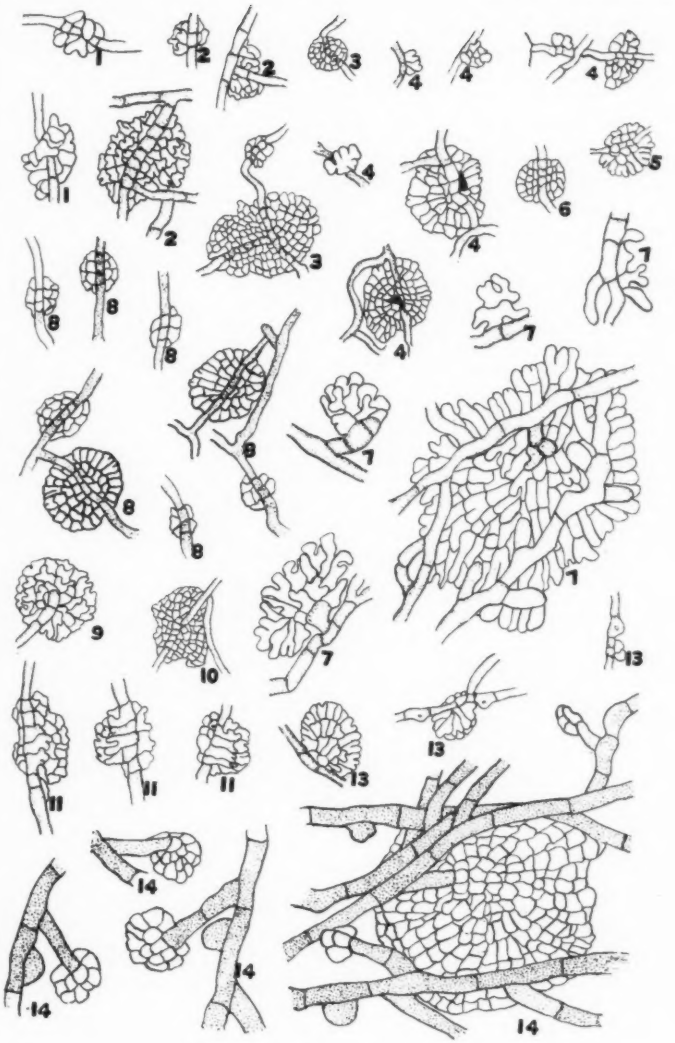
Fig. 15, *Asterina Schroeteri;* 16, *A. acanthopoda;* 17, *Morenoella decalvans* var. *Rondeletiae;* 18, *M. Pothoidei* var. *Laevigatae;* 19, *M. Psychotriae;* 20, *M. decalvans* var. *Laugeriae;* 21, *M. Laugeriae;* 22, *M. miconicola;* 23, *M. impetiolaris;* 24, *M. Miconiae;* 25, *M. Melastomacearum;* 26, *Asterina diplocarpa;* 27, *A. Arnaudia;* 28, *A. Chrysophylli;* 29, *A. dilabens;* 30, *A. Rickii;* 31, *A. Clermontiae;* 32, *A. Lobeliae;* 35, *A. dubii.*

PLATE 14

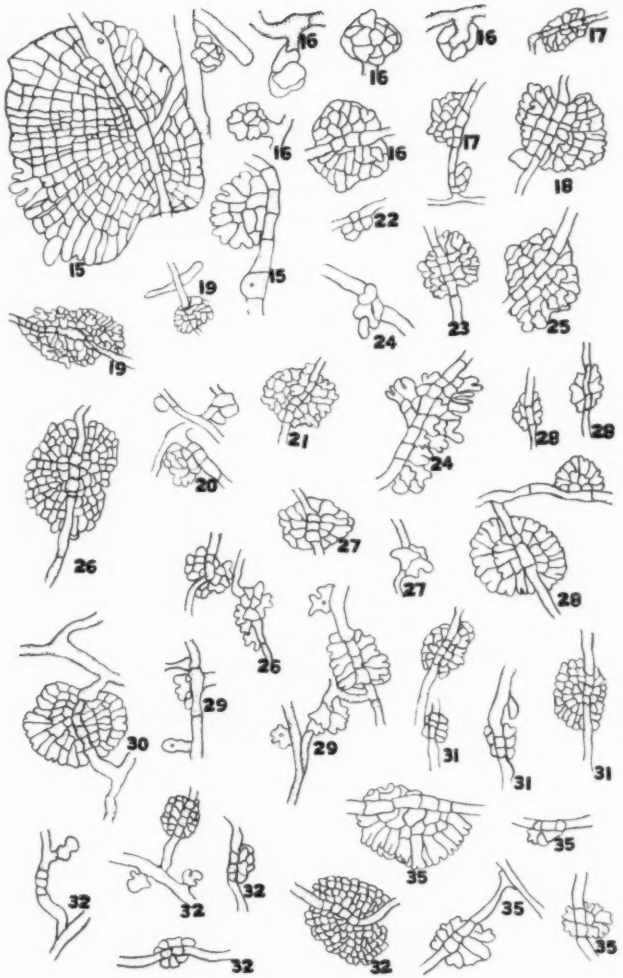
Fig. 33, *Asterina Ildefonsiae;* 34, *A. Fawcetti;* 36, *A. Hippocrateae;* 37, *A. correacola;* 38, *A. chrysophylliella;* 39, *A. kauaiensis;* 40, *Englerulaster orbicularis;* 41, *E. Papawiae;* 42, *Aulographum culmigenum;* 43, Unidentified Perisporiaceae.

PLATE 15

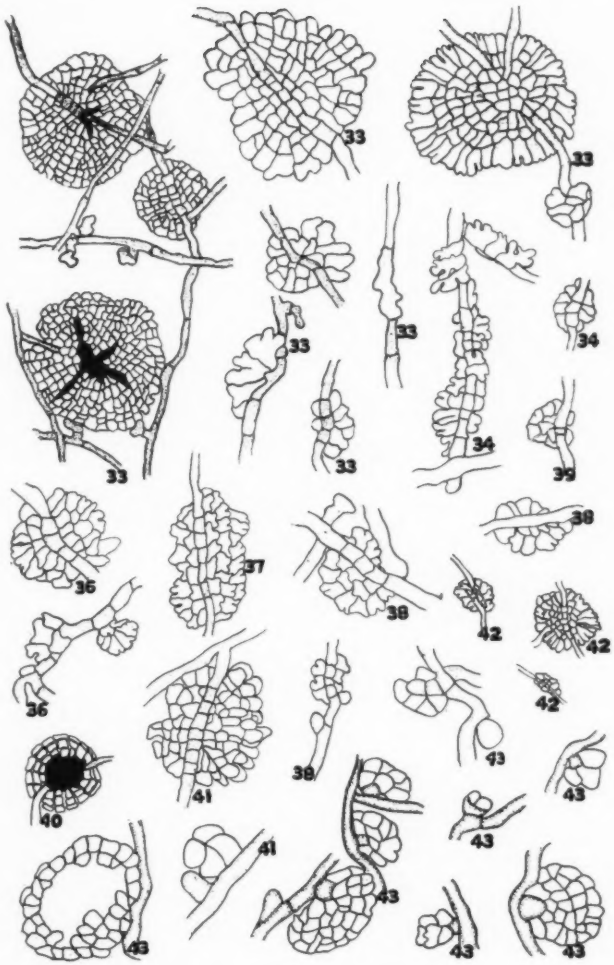
Fig. 1, *Meliola irregularis;* 2, *M. Lyoni;* 3, *M. Kaduae;* 4, *M. Koae;* 5, *M. maricaensis;* 6, *M. bidentata;* 7, *M. longipoda;* 8, *M. brasiliensis;* 9, *M. Dieffenbachiae;* 10, *M. Calophylli;* 11, *M. Juddiana;* 12, *M. hyptidicola;* 13, *M. Cyperi;* 14, *M. Kaduae;* 15, *M. Laguncolariae;* 16, *M. cyclopoda;* 17, *M. Marantae;* 18, *M. toruloidea;* 19, *M. brasiliensis.*



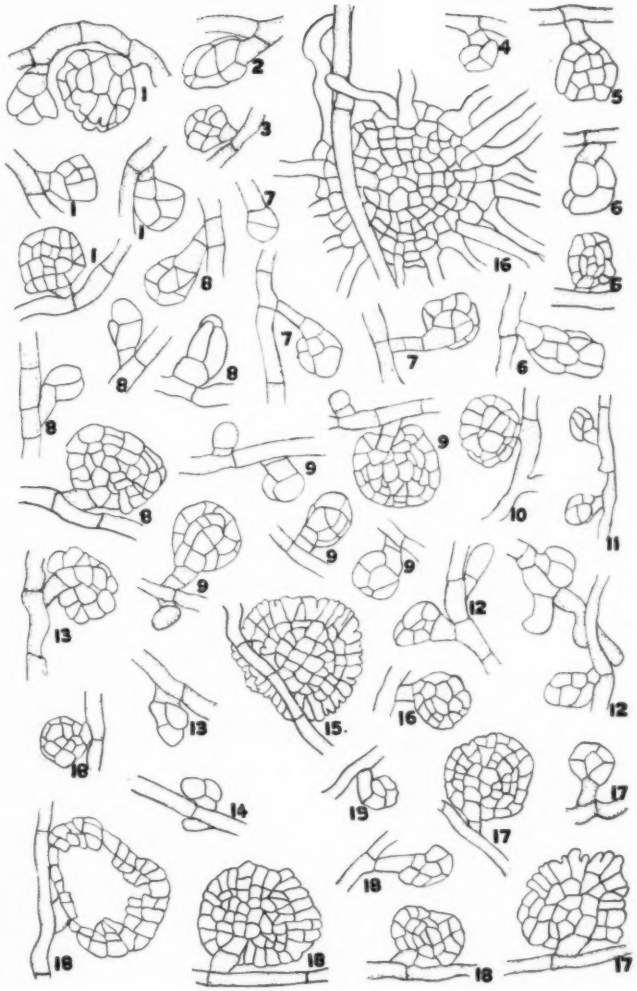
DEVELOPMENT OF PERITHECIA



DEVELOPMENT OF PERITHECIA



DEVELOPMENT OF PERITHECIA



DEVELOPMENT OF PERITHECIA

STRATIFIED SPOROPHORES OF POLYPORUS GILVUS

RAY R. HIRT

The generally accepted basis for the separation of the genus *Fomes* from *Polyporus* among the Polyporaceae is its perennial growth, whereby a new layer of tubes is added to the sporophore from year to year, since the mycelium of the context and tube layer remains alive through the year. In his description of *Polyporus gilvus* (Schw.) Fries, Dr. L. O. Overholts reports that "the plants are annual or reviving for two or three years" (1), again, that "the plants are sometimes perennial" (2). In my present study of the biology of *Polyporus gilvus* I have collected a number of sporophores which showed a distinct stratification of the tube layers, indicating that the sporophore might at times be perennial.

During the summer of 1923 I made a study of some sporophores of *Polyporus gilvus* under natural growing conditions in the vicinity of Syracuse, and I was convinced that these stratifications of the tube layers did not indicate, for these sporophores at least, that they were perennial.

In my previous work I had found that if I brought blocks of wood infected with the above fungus into the laboratory during the late winter or early spring, and kept them under certain moisture and temperature conditions, normal sporophores would develop and produce spores for culture work which I was carrying on. With this point in mind, in February 1924 I brought into the laboratory a section from the trunk of a white oak infected with *Polyporus gilvus* and upon which were a few sporophores formed during the summer of 1923. Several of these sporophores I split in half to make sure that there was only one layer of tubes present but left them attached to the bark, the remaining sporophores I left intact. Tissue cultures from these were attempted but no mycelial growth was evident, although cultures from the decayed wood were easily obtained.

Within 40 hours after the wood was brought into the laboratory patches of mycelium were noticed around the base of a number of sporophores of 1923. Tissue cultures were again attempted from these sporophores but no growth was obtained, however cultures from the patches of mycelium developed rapidly. Thus it is readily seen that the hyphae of the context and the tube layers of the 1923 sporophores were dead and not capable of further growth. The fresh mycelium which appeared in the above mentioned patches was at first white and fluffy but soon became compact and brownish. Gradually they spread outward using the dead sporophores as a substratum upon which to grow, eventually entirely enveloping them, covering the upper surface with a new context and then upon the under surface developing a new layer of tubes from which spores were cast. At this point one of these compound sporophores was removed and tissue cultures again attempted from the enclosed sporophore as well as from the one enclosing it. From the former no growth was obtained, from the latter cultures were produced, again proving conclusively that the sporophore of the previous season had no active part in the production of the new sporophore.

The remaining sporophores about which new growth had appeared were allowed to develop until late May when they were removed and sectioned. Each one of these showed stratification similar to those which I had gathered in the field and at first thought to be perennial, but the former I knew to be annual since I had observed their entire development.

Late in the summer of 1924 sporophores of that summer's growth upon a certain white oak and white ash were marked for observation during the following spring and summer. Early in June 1925 new patches of mycelium were noticed at the bases of several of these fruiting bodies. They were closely watched and were found to develop similarly to the above, so that by late summer when the sporophores were gathered and sectioned, one not acquainted with their development might easily mistake them for perennials.

Whereas the above study indicates that the mycelium of *Polyporus gilvus* lives on in decayed wood from year to year and

is therefore perennial, it also points out that the stratified sporophores of the fungus developed in this section of New York state are annuals, and I believe that this might prove to be true in other sections of the country if a careful study of the developing sporophores of *Polyporus gilvus* was made.

LITERATURE CITED

1. **Overholts, L. O.** The Polyporaceae of Ohio. Ann. Missouri Bot. Gard. **1**: 117. 1914.
2. **Overholts, L. O.** The Polyporaceae of the Middle-Western United States. Washington Univ. Studies **3**: 50. 1915.

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THE SMUTS OF PORTO RICO AND THE VIRGIN ISLANDS

H. H. Whetzel and F. D. Kern

(With Plate 16)

As there appears to be no place in which our present knowledge of the smuts of Porto Rico and the Virgin Islands has been brought together the writers have undertaken a rather complete survey of the material available in the various herbaria in this country and of the scattered literature in which reference to them is to be found. We believe that the following annotated list is reasonably complete and that the bibliography appended hereto will give the reader the important sources of the records of smuts collected in these islands.

We wish to acknowledge in this connection the generous assistance which we have received from other workers in the preparation of the manuscript. Professor H. S. Jackson, plant pathologist of the Agricultural Experiment Station at Lafayette, Indiana, has critically examined the collections made by the writers and Mr. R. A. Toro during June and July 1924, and it is to him that we are especially indebted for the determination of the bulk of our material as well as for a critical reading of the manuscript. He has also prepared the description of the new species of *Tolyposporella* on *Sporobolus*. To Dr. G. P. Clinton of the Connecticut Agricultural Experiment Station, we are indebted for much valuable assistance in the clearing up of various points relating to certain species. He has also very kindly made a critical reading of the manuscript.

In addition to our own collections we have had before us Dr. G. P. Clinton's collection made in 1904, and already largely recorded in the North American Flora, volume 7; those of the Whetzel and Olive collection of 1916; the collections by Seaver and Chardon of 1923; the private collection of Mr. J. A. Stevenson of the Federal Horticultural Board, Washington, D. C., brought together during his long period of service in Porto Rico;

and the specimens of C. M. Tucker, pathologist of the Federal Experiment Station at Mayaguez, whose collection while small has contributed two new records to the smuts of this Island, namely *Ustilago Tritici* and *Sphacelotheca Sorghi*. Specimens of smuts from Porto Rico deposited in the New York Botanical Garden herbarium have also been examined. These contained duplicates of all of the specimens of smuts collected by Dr. F. L. Stevens, botanist and plant pathologist of the University of Illinois. To all who so generously assisted by making their material available to us we wish to express our keen appreciation and thanks as well as to all the others who in one way or another have assisted in making this list complete and accurate.

The list shows at a glance that the smut flora of Porto Rico and the Virgin Islands is very limited compared, for example, with the rust. But eight genera of smuts have thus far been found in these islands representing a total of 19 species certainly known to occur there. The genera *Doassansia* and *Urocystis* previously reported from Porto Rico appear to be based upon errors in determination.

Not only are the number of species of smuts occurring in these islands relatively few in number but they are for the most part rare or at least uncommon there, judging by the collections which have thus far been made. A few of them are common and widely distributed in Porto Rico, notably, *Ustilago affinis* on crab grass, *Sphacelotheca Panici-leucophei* on *Valota insularis*, *Cintractia axicola* occurring everywhere on *Fimbristylis diphylla*, *Cintractia leucoderma* on *Rynchospora corymbosa* and *Thecaphora pustulata* on *Bidens pilosa*. Among the forms herein reported the following appear to be peculiar to these islands on the hosts indicated: *Thecaphora pustulata* on *Bidens pilosa*, *Cintractia limitata* on *Cyperus ligularis*, *Cintractia minor* on *Cyperus sphacelatus*, *Entyloma Lobeliae* on *Lobelia Cliffortiana*, *Cintractia axicola* on *Fimbristylis ferruginea*, *Cintractia leucoderma* on *Rynchospora cyperioides*. In the case of the last two named species the hosts reported appear to be new for their respective species. A new species *Tolyposporella Sporoboli* Jackson on *Sporobolus indicus* is herein described.

All the specimens in the collection of Porto Rican fungi in

the herbarium of Cornell University have been cited by number. Since these collections have been made at different times and numbered consecutively beginning with the Whetzel and Olive collection of 1916, the collectors' initials have been placed before the numbers cited: *W. & O.* refers to the specimens collected by Whetzel and Olive; *Char.* to collections by Chardon alone; *S. & C.* to collections made by Seaver and Chardon; *W. K. & T.*, collections made by Whetzel, Kern and Toro. The Sintenis specimens cited are all to be found in the herbarium of the N. Y. Botanical Gardens. All specimens of Stevens' collection, "Porto Rican Fungi," Herbarium, University of Illinois, deposited in the New York Botanical Garden Herbarium, are cited as *St.* In some cases the specimens of other collectors are also specifically referred to in which case the collector's name with the number on the packet are given as in the case of collections by Clinton, Stevenson, Johnston, Tucker, etc. Not all of the specimens of such collectors are referred to, only those being cited which appear to be of special interest.

Order USTILAGINALES

Family 1. USTILAGINACEAE

USTILAGO (Pers.) Roussel. Fl. Calvados ed. 2, p. 47. 1806

USTILAGO AFFINIS Ellis & Ev.; Cockerell, Bull. Torrey Club **20**: 297. 1893.

Ustilago Hilariae P. Henn. Hedwigia **37**: 267. 1898.

Ustilago Stenotaphri P. Henn. Hedwigia **37**: 293. 1898. (Not *U. Stenotaphri* of McAlpine.)

Ustilago americana Speg. Anal. Mus. Nac. Buenos Aires **6**: 207. 1899.

Ustilago Henningsii Sacc. & Sydow, in Sacc. Syll. Fung. **16**: 368. 1902.

On *Stenotaphrum secundatum* (Walt.) Kuntze.

One of the commonest smuts in Porto Rico and Vieques: Known also from Bermuda, Jamaica and Mexico.

USTILAGO SCHRÖTERIANA(?) P. Henn. Hedwigia **35**: 215–216. 1896.

On *Paspalum* sp. Johnston N. Y. Bot. Gard. *(4)641*; Rio Piedras Exp. Sta. P. R. *4641*.

Referred by Stevenson (Jour. Dept. Agr. Porto Rico **2**: 162. 1918) to *Sphacelotheca Paspali-notati* under which see: Type from Brazil.

USTILAGO SEGETUM Dittm.

A smut is listed under this name by Klotzsch (**1852**: 364) from Schwanecke's Porto Rican collections. No host is given. As this is an old name applied collectively to the smuts of cereals it is impossible to determine just what species he had. His specimen has not been seen.

USTILAGO TRITICI (Pers.) Rostr. Overs. Danske Vid. Selsk. Forh. **1890**: 15. March 1890.

Uredo segetum Tritici Pers. Tent. Disp. Fungi. **57**. 1797.

Ustilago segetum Tritici Jens. Om Korns. Brand 61. 1888.

Ustilago Tritici Jens.; Kellerm. & Swing. Ann. Rep. Kansas Exp. Sta. **2**: 262. June 1890.

Ustilago Tritici f. folicola P. Henn. Zeitschr. Pflanzenkr. **4**: 139. 1894.

On *Triticum aestivum* L. (= *T. vulgare* Vill.).

But one collection of this smut is known to the writers from Porto Rico, that by C. M. Tucker his number *300* (= Cornell Univ. Herb. No. *14936*). Common in all temperate regions where wheat is grown.

USTILAGO ZEAE (Beckm.) Unger. Einfl. Bodens. 211. 1836.

Lycoperdon Zeae Beckm. Hannov. Mag. **6**: 1330. 1768.

Ustilago Maydis Corda, Ic. Fung. **5**: 3. 1842.

Ustilago Zeae-Mays Wint. Rab. Krypt.-Fl. 1^1: 97. 1881.

On *Zea Mays* L.

Reported by Clinton (**1906**: 15) from Porto Rico but not represented in his 1904 collection. Reported also by Stevens (**1917**) *5812* and Stevenson (**1918**) *6618*. There is also a specimen in the collection of C. M. Tucker, *301*.

Apparently not common in Porto Rico: Occurring wherever maize is grown.

SPHACELOTHECA De Bary, Verg. Morph. Biol. Pilze, p. 187. 1884

SPHACELOTHECA PANICI-LEUCOPHAEI (Bref.) Clinton, N. Am. Fl. **7**: 28. 1906.

Ustilago Panici-leucophaei Bref. Unters. Gesammt. Myk. **12**: 114. 1895.

Ustilago insularis P. Henn. Hedwigia **35**: 51. 1896.

On *Valota insularis* (L.) Chase. *W. & O. 451, 453; W. K. & T. 2131, 2140, 2147; St. 40, 1368, 4297; N. Y. Bot. Gard. 563.*

The entire inflorescence is converted into a dull brown dusty mass as it emerges from the upper leaf sheath. A very common smut in Porto Rico and Vieques: Reported also from Cuba, Jamaica, Central and South America, Mexico and Arizona.

SPHACELOTHECA PASPALI-NOTATI (P. Henn.) Clinton, Jour. Myc. **8**: 140. 1902.

Ustilago Paspali-notati P. Henn. in Herb. Holway. Clinton, Jour. Myc. **8**: 140. 1902.

On *Paspalum* sp.

Recorded in Porto Rico by Stevenson from near Rio Piedras (**1918**: 162). No specimen of this was found in Stevenson's private collection: His record is presumably based upon a specimen under this name (*4641*, Herb. Exp. Sta. Rio Piedras, P. R.) part of which is now in the N. Y. Botanical Garden Herbarium, (*4*)*641*, collected by J. R. Johnston near Rio Piedras, Dec. 21, 1912. The host is evidently a *Paspalum* but the species cannot be determined with certainty. It is clearly not *P. notatum*. The spores of this smut are much larger than those of the type specimen of *S. Paspali-notati*. It is, according to H. S. Jackson (letter Nov. 23, 1925), probably *Ustilago Schroeteriana* P. Henn. (Hedwigia **35**: 215–216. 1896), the type specimen of which has not been seen; it is probably in the Berlin Museum: *S. Paspali-notati* is known only from the type locality in Mexico.

SPHACELOTHECA SORGHI (Link) Clinton, Jour. Myc. **8**: 140. 1902.

Sorosporium Sorghi Link, in Willd. Sp. Pl. **6**^{2}: 86. 1925.

Tilletia Sorghi-vulgaris Tul. Ann. Sci. Nat. III. **7**: 116. 1847.

A. CINTRACTIA LEUCODERMA (BERK.) P. HENN.
B. CINTRACTIA UTRICULICOLA (P. HENN.) CLINTON

Ustilago Sorghi Pass. Thüm. Hedwigia **12**: 114. 1873.

Ustilago Tulasnei Kühn, Ber. Sitz. Nat. Ges. Halle **1874**: 5. 1874.

Cintractia Sorghi-vulgaris Clinton, Bull. Ill. Exp. Sta. 47: 404. 1897.

On *Holcus Sorghum* L. (*Sorghum vulgaris* Pers.).

A single collection by C. M. Tucker *258*, (= Cornell Univ. Herb. *12638*) is known to the writers from Porto Rico: Known also from Cuba, Jamaica, Canada, United States, Europe, Asia and Africa.

CINTRACTIA Cornu, Ann. Sci. Nat. VI. **15**: 279. 1883

CINTRACTIA AXICOLA (Berk.) Cornu, Ann. Sci. Nat. VI. **15**: 279. 1883.

Ustilago axicola Berk. Ann. Mag. Nat. Hist. II. **9**: 200. 1852.

Ustilago Fimbristylis Thüm. Bull. Torrey Club **6**: 95. 1876.

On *Fimbristylis diphylla* (Retz.) Vahl. *Clinton 47; S. & C. 2039; W. K. & T. 2135, 2139, 2141, 2143; Johnston N. Y. Bot. Gard. 906a; St. 1874, 4838, 5821, 1881, 5818, 4538, 5033, 5162, 5729, 668; Stevenson* (*N. Y. Bot. Gard.*) *2179*, (*N. Y. Bot. Gard.*) *748a;* (*N. Y. Bot. Gard.*) *Fishlock 67.*

On *Fimbristylis ferruginea* (L.) Vahl. *W. K. & T. 2142; St. 1798.*

The second named host appears to be a new one for this smut. Very common in Porto Rico. Also recorded from St. Thomas (Seaver **1924**: 10) and Tortola *N. Y. Bot. Gard. 748a* and *Fishlock 67:* Southern U. S.; Mexico, Central America, Cuba, Jamaica, Santo Domingo and St. Kitts.

CINTRACTIA LEUCODERMA (Berk.) P. Henn. Hedwigia **34**: 335. 1895.

Ustilago leucoderma Berk. Ann. Mag. Nat. Hist. II. **9**: 200. 1852.

Cintractia Krugiana P. Magn. Bot. Jahrb. **17**: 490. 1893.

Cintractia affinis Peck, N. Y. State Mus. Bull. **67**: 28. 1903.

On *Rynchospora corymbosa* (L.) Britton. PLATE 16, FIG. A. *S. & C. 2028; W. K. & T. 2134; St. 9277, 836,* (*5254a, 5254, 5782, 5610,* probably this host, may be *R. gigantea;*

material too scant for accurate determination). *Johnston 1168; Stevenson 6408, 2208* (?).

On *Rynchospora cyperioides* (Sew.) Mart. *W. & O. 454; S. & C. 2046.*

On *Rynchospora gigantea* Link. *Sintenis 6672* Type.

There are in the New York Botanical Garden Herbarium, marked Ellis Collections, two specimens of *C. leucoderma* from Porto Rico on *R. gigantea* apparently duplicates from Sintenis' collection since one is a part of the type cited by Magnus in his original description of *C. Krugiana 6672*, the collectors being Krug and Urban. The other specimen collected at Manati by the same collectors bears no number. Neither are dated. These are the only specimens known with certainty to have been taken on this host in Porto Rico.

Easily recognized by the long white covered sori which involve the pedicles and peduncles of the inflorescence. *R. cyperioides* appears to be new for this smut.

Locally very abundant in Porto Rico on *R. corymbosa* especially along streams about San Juan. Often occurring along with *C. utriculicola* on this host: Florida, New York, Cuba, Isle of Pines, Santo Domingo, Mexico, South America, Central America, Asia and Australia.

CINTRACTIA LIMITATA Clinton, Proc. Boston Soc. Nat. Hist. **31**: 399. 1904.

On *Cyperus ligularis* L. (*Mariscus ligularis* Urban). *Clinton 3; 167* (part in N. Y. B. G.); *St. 5309, 4854, 1852, 1850.*

Apparently common. Known only from Porto Rico; Mayaguez, Manati, Santurce, Boqueron and San Juan being the stations represented in the collections seen.

CINTRACTIA MINOR Jackson, Mycologia **12**: 153. 1920.

Cintractia axicola minor Clinton, Jour. Myc. **8**: 143. 1902.

On *Cyperus sphacelatus* Rottb. *Clinton 117; Johnston & Stevenson (N. Y. Bot. Gard.) 1513; W. & O. 455, 456; W. K. & T. 2138.*

This appears to be a rather uncommon species in Porto Rico. The only other places from which it is reported are New York, New Jersey and Delaware where it occurs on *Cyperus Grayii* (Jackson, Mycologia **12**: 153).

CINTRACTIA UTRICULICOLA (P. Henn.) Clinton, Jour. Myc. **8**: 143. 1902.

Cintractia leucoderma, f. urticulicola P. Henn. Hedwigia **34**: 336. 1895.

Cintractia axicola, f. spicularum Juel, Bih. Sv. Vet.-Akad. Handl. **23** (3) 10: 7. 1897.

On *Rynchospora corymbosa* (L.) Britton (*Rynchospora aurea* Vahl). PLATE 16, FIG. B. *W. K. & T. 2133; St. 1061a, 6783; Seymour & Earle, Ec. F. C105*, coll. by Clinton 1904; *N. Y. Bot. Gard. 6967.*

Occurring frequently along with *C. leucoderma* on *R. corymbosa*. Apparently not common in Porto Rico: Known also from Mexico, Trinidad and South America.

MYKOSYRINX G. Beck, Ann. Nat. Hofmus. Wien **9**: 123. 1894

MYKOSYRINX CISSI (DC.) G. Beck, Ann. Nat. Hofmus. Wien **9**: 123. 1894.

Uredo Cissi DC. in Poir. Encycl. Meth. Bot. **8**: 228. 1808.

Geminella exotica Schröt. Hedwigia **15**: 135. 1876.

Schroeteria Cissi De-Toni, Sacc. Syll. Fung. **7**: 501. 1888.

On *Cissus erosa* L. C. Rich (Cited as *190* of Sintenis by Magnus **1893**: 189. No specimen of this in N. Y. Bot. Gard. herbarium).

On *Cissus sicyoides* L. *Sintenis, 1886.*

On *Cissus trifoliata* L. (*C. acida* L.). *N. Y. Bot. Gard. 4795, Sintenis 791, Ricksecker*, St. Croix *406.*

On *Cissus* sp. Syd. Ustilag. *48, Sintenis 3004, N. Y. Bot. Gard. 513.*

While this species would appear to be common in Porto Rico, judging from the number of collections of it taken by earlier collectors, it is remarkable that it appears not to have been found by Stevens or any of the succeeding collectors. A single specimen is known from St. Croix: Florida, Mexico, Cuba, Isle of Pines, Bahamas, Jamaica, Santo Domingo, Trinidad, Central America, South America and Africa.

THECAPHORA Fingerh. Linnaea **10**: 230. 1835

THECAPHORA PUSTULATA Clinton; Chardon, Revista Agr. P. R. **6**[4]: 21–23. 1921.

On *Bidens pilosa* L. (*B. leucantha*). *Stevenson* (*N. Y. Bot. Gard.*) *5977; W. & O. 458; Char. 983; W. K. & T. 2136, 2137, 2144.*

Causing soft gall-like swellings of various sizes up to an inch in diameter on stems, leaves and petioles.

Frequent throughout Porto Rico. Not known elsewhere.

TOLYPOSPORELLA Atk. Cornell Univ. Exp. Sta. Bull. **3**[1]: 16. 1897

TOLYPOSPORELLA BRUNKII (Ellis & Gall.) Clinton, Jour. Myc. **8**: 147. 1902.

Ustilago (*Sorosporium?*) *Brunkii* Ellis & Gall. Jour. Myc. **6**: 31. 1890.

Ustilago apiculata Ellis & Gall.; Jennings, Texas Exp. Sta. Bull. 9: 29. 1890.

On *Andropogon bicornis* L. *W. & O. 449.*

Black linear sori mostly along midrib of leaf, underside. Known in Porto Rico from the single collection by Whetzel & Olive No. *449* from E. Yunque: Reported from Texas and Mexico.

Tolyposporella Sporoboli Jackson n. sp.

Sori on outer surface of leaf sheaths and on (apparent) upper surface of leaves, forming linear striae 1–10 mm. long, scattered and usually not confluent, epidermis usually rupturing along one side, conspicuous, cinereous; spores variable in size, somewhat irregularly globoid, 10–15 μ in diameter, more or less agglutinated but not in definite spore balls, outer wall often drawn out to a point on one side so that the spores appear pyriform and then up to 18 μ long, often in pairs; wall chestnut brown, smooth, 2.5–4 μ thick.

On *Sporobolus indicus* (L.) Br. E. Yunque, Porto Rico, Apr. 14, 1916, *W. & O. 450* Type.

This species differs from the other species of this genus which have been described, primarily in the character and position of the sori. Superficially the smut resembles the telial stage of a rust.

Family 2. TILLETIACEAE

UROCYSTIS Rab.; Klotzsch, Herb. Viv. Myc. ed. 2. *393.* 1856.

UROCYSTIS CEUPLAE Frost; Farl. Ann. Rep. Sec. Mass. Bd. Agr. **24**: App. 195. 1877.

On *Allium Cepa* L.

Mentioned by Henricksen (1906). No specimens of this fungus from Porto Rico known. According to Stevenson (**1918**: 163) this smut probably does not occur there.

ENTYLOMA De Bary, Bot. Zeit. **32**: 101. 1874

ENTYLOMA AUSTRALE Speg. Anal. Soc. Ci. Argent. **10**: 5. July 1880.

Protomyces Physalidis Kalchb. & Cooke, Grevillea **9**: 22. Sept. 1880.

Entyloma Besseyi Farl. Bot. Gaz. **8**: 275. 1883.

Entyloma Physalidis Wint. Hedwigia **22**: 130. 1883.

On *Physalis pubescens* L. (Host determined by N. L. Britton). *Clinton 132* (N. Am. Fl. **7**: 64); *W. & O. 491, 489, 488.*

Known from Porto Rico only in the above cited collections: United States, Canada, South America and Africa.

ENTYLOMA GUARANITICUM Speg. Anal. Soc. Ci. Argent. **17**: 127. 1884.

On *Bidens pilosa* L. (*B. leucantha*). (*Clinton no number*); *W. K. & T. 2145, 2146; Seym. & Earle, Ec. Fungi C 107* collected by Clinton 1904.

Pale white spots on the leaves.

There are but four collections of this from Porto Rico known to the writers. Probably common especially at high altitudes. Inconspicuous and hence easily overlooked: Known also from Massachusetts (?), Florida and South America.

ENTYLOMA LOBELIAE Farl. Bot. Gaz. **8**: 275. 1883.

On *Lobelia Cliffortiana* L. *Clinton 134.*

Clinton's collection is the only one known to the writers from Porto Rico. This was reported by him as on *Lobelia* sp. (N. Am. Fl. **7**: 64). The writers submitted Clinton's specimen for determination to Dr. N. L. Britton, who identifies it as *L. Cliffortiana:* Known otherwise only from N. America on *Lobelia inflata.*

BURRILLIA Setch. Proc. Am. Acad. **26**: 18. 1891

BURRILLIA ECHINODORI Clinton, Jour. Myc. **8**: 154. 1902.

On *Echinodorus cordifolius* (L.) Griseb.

A single collection, *335*, was made by Stevens in Porto Rico. Duplicates of this collection were distributed by Bartholomew in *Fungi Columb. 5002*. There is also a specimen in the private collection of John A. Stevenson *3838* a part of which is deposited in Cornell Univ. Herb. under No. *14935*. Apparently rare: Known also from Florida and California.

DOASSANSIA Cornu, Ann. Sci. Nat. VI. **15**: 285. 1883

DOASSANSIA SINTENISII Bres. Bot. Jahrb. **17**: 489. 1893.

On *Cedrela odorata* L.

Clinton (**1906**: 71) excludes this species, remarking "Probably insect work." There are three specimens apparently all of the same collection of this from the Sintenis collection in the N. Y. Bot. Gard. Herbarium all dated 1887, collected at Utuado. A careful examination of these specimens confirms Clinton's diagnosis.

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A BIT OF POLYNESIAN MYCOLOGY

THOMAS H. MACBRIDE

The material basis for these brief notes consists of two specimens of *Stemonitis* collected in Suva by Professor A. O. Thomas, and a fine box of mounted material, chiefly myxomycetal, collected and prepared by Dr. G. H. Cunningham of New Zealand, and sent to the University of Iowa by the hand of Professor R. B. Wylie, in September, 1922, with a second packet arriving a few months later.

These materials are interesting in many ways. The regions, of course, are well isolated, not only from each other, but also from the continental masses of the northern world. Island habitats both; New Zealand, because of size, age and topographic structure, offers an indigenous flora, abundant, rich, varied, three fourths of it unique, tracing perhaps to a previous geologic period.

Furthermore, for the last one hundred and fifty years the introduction of alien plants has for these regions been constant, due to the increasing occupancy of the country by Europeans. More recently, in New Zealand, in an effort at reforestation, large areas are planted with foreign species, among which the Californian *Pinus radiata* has, just now, a very important place.

Viti, or Fiji, is in practically the same situation; not so large, innovations whether of plants or ideas have naturally not been so early nor so great; but for a century, ships,—notably of the United States long ago,[1] and increasingly from England, since 1871,—have introduced all manner of plants useful in civilized life. Results concerning the distribution of mycologic species are now to be expected. Let us consider the Myxomycetes first and begin with the larger collections, those from New Zealand.

[1] 1838–43. Vide Rep. Wilkes and Hale Exploring Expedition. Vol. 3.

I. MYXOMYCETES FROM NEW ZEALAND[2]

1. BADHAMIA UTRICULARIS (Bull.) Berk.

Specimens so referred have the characteristic spores, in size and in tendency to adhere in varying clusters. In one respect however one of Mr. Cunningham's gatherings differs pronouncedly from any specimens of *B. utricularis* I have so far examined. I find in the sporangia now and then a strong columella, quite as in *Craterium* for instance, or the more decidedly columellate species of *Physarum*. This peculiarity may result from meteoric conditions at the time of maturing. Future collections must determine.

*2. BADHAMIA CAPSULIFERA Berk.

This species is represented by a very peculiar phase. The adherent spores are in all respects normal, but the fructification as a whole is erionemoid! The sporangia are small, distributed as bead-like enlargements of the flaccid and thread-like, far-extended stipe. When blown out, as the material before us is, the resemblance is to *Erionema*.

This may be an unusual presentation; if not, it deserves recognition as varietal at least;—*B. capsulifera* Berk. form—*monilifera*.

*3. PHYSARUM STRAMINIPES Lister.

This is a beautiful, easily recognized species, distinguished by the long yellowish membranaceous stalks and especially by the unequal distribution of warts upon the epispore, giving to the entire surface a very peculiar spotted appearance.

Hitherto reported from western Europe only.—Imported from England?—or, is England importing?

[2] For our knowledge of mycologic flora in the south sea islands, we have until recently depended almost entirely upon the publications of Rev. M. J. Berkeley (1853–59) known throughout the world. He and his associates are responsible for a large part of current nomenclature in the subject, so far as referable to English sources.

More recently, however, Mr. Lister (Jour. Bot. London **43**: 111–114. 1905) has published a list of New Zealand slime-moulds, and these are mentioned as well in the second edition of the "Mycetozoa"; 1911.

In the present list the (*) indicates forms not hitherto reported from the regions named, so far as shown by the lists cited, supplemented by Saccardo references.

4. PHYSARUM LEUCOPHAEUM Fries.

To arouse liveliest discussion this species needs only to be named. Described first by Fries a century ago, in literature it dips in and out of view in fashion quite surprising. The erect pose, due to a flat sporangium base, and rather stout short stem seem to distinguish the form. In New Zealand apparently all these characters are emphasized; we have, indeed, a phase properly described as robust, had that term not already been applied in description of another species of the genus. The form before us is larger, stouter, more vigorous looking in every way, but in essential points the same as the Friesian type.

*5. PHYSARUM VIRIDE Pers.

This familiar species is also represented by sporangia larger and more rigid than have been seen, at least in collections in America.

6. CRATERIUM MINUTUM (Leers) Fries.

Three colonies are at hand varying somewhat with each other, badly weathered, open and more or less yellow; a not unusual variation.

*7. DIDERMA HEMISPHERICUM (Bull.) Hornem.

Weathered but typical.

8. DIDYMIUM SQUAMULOSUM (Albert. & Schw.) Fries.

Typical.

*9. LAMPRODERMA VIOLACEUM (Fries) Rost. var. *Sauteri* Rost.

This is an old-world species. The form *L. Sauteri* R. a variety only.

*10. COMATRICHA NIGRA (Pers.) Schröt.

11. COMATRICHA TYPHOIDES (Bull.) Rost.

12. STEMONITIS AXIFERA (Bull.) Macbr.

*13. STEMONITIS FLAVOGENITA Jahn.

*14. ENTERIDIUM LICEOIDES List.?

E. liceoides is thought closely related to *E. olivaceum* Rost.

The material before us, if here properly referred, does not support that view. *E. olivaceum* shows a small, definitely depressed, thin aethalium, with the internal structure much as in *E. splendens* Morg. In the present gathering, the aethalia are associated, and of varied form and size, from hemispherical—when smaller—to irregular, depressed and some 2 or 3 cm. in extent. In the smaller, so far as examined, no capillitial structures appear; in the larger, certain nondescript, irregularly perforate strands occur sparingly. The adherent spores in either case are similar to those of *E. olivaceum*, but have longer spines. The absence of capillitium in the globose aethalia suggested no doubt the specific name *E. liceoides;* in the present gathering the globose fructifications are liceas with spinulose spores.

15. LYCOGALA EPIDENDRUM (Buxb.) Fries.

Cosmopolitan, as would appear.

16. ARCYRIA INCARNATA Pers.

Typical.

17. ARCYRIA DENUDATA (L.) Sheld.

18. HEMITRICHIA SERPULA (Scop.) Rost. var.?

The plasmodiocarp is not very different from that of the common species, the color inclined to brown; the dehiscence lateral, the capillitial thread netted with few free ends, these abrupt and hamate, *thoroughly spinescent*, the spinules 1–3 μ; the spores netted, 3–5 on the hemisphere, 9–12 μ; the equatorial circle about $\frac{1}{3}$ μ in width.

Differs from the type in larger dimensions throughout. Further collection must determine the real significance and persistence of the peculiarities noted.

19. TRICHIA VARIA (Pers.) Rost.

20. TRICHIA VERRUCOSA Berk.

21. TRICHIA DECIPIENS (Pers.) Macbr.

22. TRICHIA LATERITIA Lév.

A second sending of Myxomycetes from Mr. Cunningham came recently to hand; this included the species following:

1. **Badhamia calvescens** n.s.

Fructification closely gregarious; sporangia dark grey, ovate or cylindric, sessile, or narrowed below, but not strictly stipitate; about 1 mm. high, with apical dehiscence; the capillitium dense, the tubules very short, the nodes large, irregular, white, physaroid, more or less aggregate at the center, otherwise no columella; spores dark violaceous, coarsely spinulose, thick-walled save for a limited area apparently thinner, but bearing a few scattered spinules, 12–14 μ.

Resemblance is with *B. papaveracea* (Berk.) Rost.; the spores are adherent in fours, apparently; but there are no stems and the sporangia are cylindric or irregularly prolate.

2. PHYSARUM GLOBULIFERUM (Pers.) Rost.?

This species, believed cosmopolitan, varies constantly. Many varieties have been recognized in the United States. The variations affect the color of the peridium, the length and to some extent the structure of the stipe, etc.

The present gathering is not exceptional; it simply suggests a new variety!

The fructification is loosely gregarious, stipitate; the sporangia more or less globose, often flattened below; the peridium smooth, persistent, white; the stipe not long, but longer than the diameter of sporangium, terete and fluted or flat, strand-like, white or pallid; columella slight or obsolete; capillitium regular, the nodes white and small, uniform, ellipsoidal, the connecting filaments persisting, tubular; spores violet-brown, delicately verruculose, 8 μ.

The peridial and stem characters are divergent from the type; the capillitium and spores typical. Reference provisional.

*3. DIDYMIUM XANTHOPUS (Ditmar) Fries.

A common and widely distributed species.

II. MYXOMYCETES FROM SUVA

1. STEMONITIS HERBATICA Peck.

This species is based upon material originally collected in New York in 1874; not common in other parts of the American con-

tinent. Now here, behold it in mid-ocean on the opposite side of the world!

The question is, is it in Suva indigenous? It does seem unlikely that the species originates where now discovered; it was more probably introduced within the last fifty years. Wilkes, as noted, visited and in 1840 made a survey of the Viti group; but he was two years en route, too long for viable spores, it is believed. If introduced, the case is more recent; the journey is now accomplished in thirty days.

2. STEMONITIS FUSCA Rost., form VERRUCULATA.

This species, in one phase or another, is common in the forests of the northern world. As now identified it is made to include forms not falling definitely within the Polish description, 'spores smooth'! no; but as well, forms having spores netted, and finally, netted and spinulose! The spinules rise, when present, as slender, acicular spines from the mesh-corners of an episporic net.

In the form before us the epispore betrays no net, no spines, but verruculae instead. Otherwise the specimens do not very much differ from American types of *S. fusca* Rost. as at present constituted for western Europe.

To conclude this brief discussion of a fine list of most interesting myxomycetal forms, it will be not wholly inappropriate to refer here to certain minor, inconspicuous but none the less elegant hyphal sporocarps which everywhere masquerade in the garb or physiognomy of slime-mould species. These are always interesting; those now at hand especially so, as may appear.

That such wrong association should at all be possible is largely due no doubt to sheer unskilfulness of those who in such cases write descriptions; perhaps a little, besides, to Nature's quite economic use of her several elements of beauty. Of beauty, as of its correlative truth, there has apparently never been enough in this world to go around; not quite,—and so form-mimicking is possible. That is to say, in form, or color, or in some peculiar character very different small organisms offer betimes an outward surface-resemblance to each other, and no description can be drawn so infallible in wording as to admit of no misapplication.

Accordingly solenias, small puff-balls, hyphomycetes in various forms often claim as against sessile forms of *Trichia*, *Lycogala*, *Enteridium*, etc. The difference is basic; the first-named forms are fungi, the latter slime-moulds, to start with.

To the student both groups are of equal interest. To illustrate we may close our present study with a mention of two or three of these mimic fungi.

1. PILACRE DIVISA Berk.

Fructification scattered or gregarious; the sporocarp grey-ferruginous, more or less pilose, depressed-globose, umbilicate below; in greater diameter 1–3 mm.; stipe grey, stout, tapering upward, then enlarged and separating into two or more branches entering as one the umbilicate sporocarp, height 2–5 mm.; sporules subglobose, thick-walled, bright ferruginous, smooth, catenulate in 8s (?), 5–7 μ.

Reported by Berkeley from Bay Islands, New Zealand, in 1876. The present specimens are from the same locality. So far as appears, this is the first notice of the species since Berkeley.

2. **Coremium gracile** n.s.

Fructification consisting of stipitate sporocarps, scattered, inclined to be closely gregarious; the capitula ovoid or spherical, becoming prolate; at first dark brown, paler at top, girt with white below, at maturity wholly white with falling spores, small, about $\frac{1}{4} \times \frac{1}{6}$ mm.; stipe clear brown, rigid, erect, even, 1.5–2 mm.; spores catenulate, smooth, 4–5 μ. N. Zealand.

3. CALONECTRIA POLYTHALAMA (Berk.) Sacc.

This handsome little species was described, it is believed, by Berkeley in 1876, from Bay Islands, New Zealand. It occurs also, strangely enough, in the southern forests of United States, Mississippi, Alabama. See above, record of No. 1.

IOWA CITY, IOWA

SKETCHING FLESHY FUNGI WITH THE AID OF THE CAMERA LUCIDA[1]

LOUIS C. C. KRIEGER

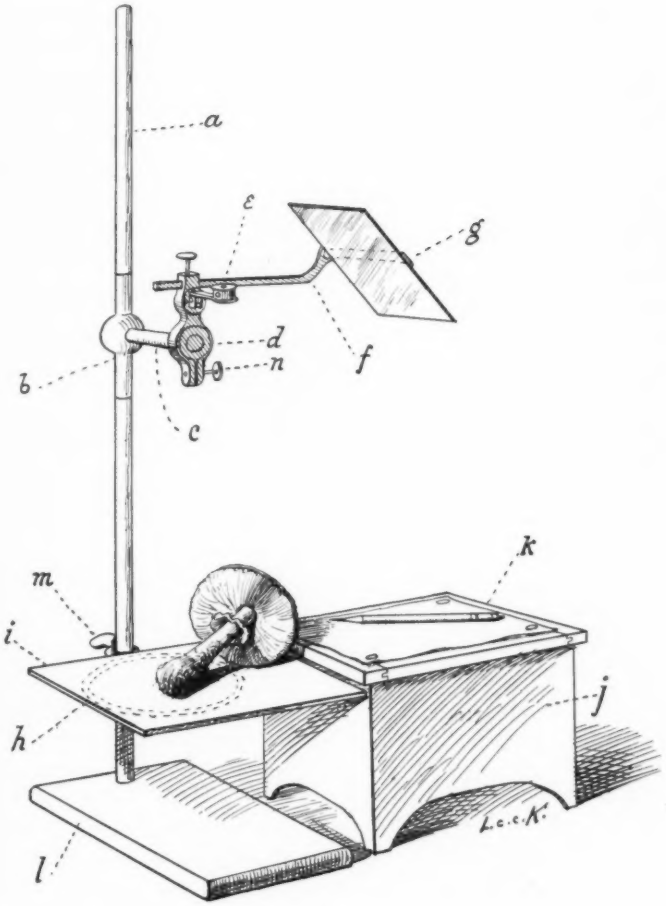
(WITH PLATE 17)

In order to complete the record of a fleshy fungus mycologists are sometimes called upon to make drawings. As free-hand sketching is not usually one of their accomplishments, an account of a simple method for obtaining accurate outlines with little effort and practically no skill may be of interest. An instrument that few laboratories lack, the camera lucida, together with a chemist's ring stand, is the equipment.

While engaged in painting cacti (*Opuntia* species) at Chico, California (1912–1917), for the U. S. Department of Agriculture, under the direction of Dr. David Griffiths, the writer, at the suggestion of this gentleman, employed light, photographic platinum-prints as a basis for the superimposed color-work on the flat-jointed (*Platyopuntia*) species. Others, of the "cholla" (*Cylindroöpuntia*) type, and the buds, flowers, and fruits of nearly all species indiscriminately, were at first drawn free-hand, and then colored. The latter procedure proved time-consuming, and a means was sought to expedite the preliminary drawing of so much complicated detail. Having had occasion to use the camera lucida in drawing microscopic objects, it occurred to the writer that this instrument might be turned to account.

A camera of the type in which the prism-chamber (Pl. 17, *e*) is inclinable on a hinge, made adaptation to macroscopic drawing an extremely easy matter, the chemist's ring-stand serving as the support. The latter consists of a vertical, twenty-four-inch steel rod (*a*) that fastens into a lacquered-iron base (*l*), and of several iron rings (*h*, in dotted lines) that may be moved up and down on the rod and secured at any point thereon by means of a screw (*m*). Only one ring, a large one, was retained to hold a

[1] Contribution from The Howard A. Kelly Mycological Library, Baltimore, Md.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thin board (*i*), the platform, on which the *Opuntia* joint, bud, or fruit was placed.

Another item was a piece of steel tubing (*b*), about three inches long, and of a diameter that permitted one to move it up and down on the steel rod with ease, and yet without any perceptible looseness in the fit. From the middle of this piece of tubing, and at right angles to it, projected a solid, cylindrical, iron arm (*c*), the free end of which formed the point of attachment for the ring-clamp (*d*) of the camera, the part that ordinarily clasps the microscope tube. As the diameter of the iron arm was considerably less than that of the ring-clamp, a piece of hard ink-rubber was perforated with a circular hole the exact size of the iron arm. This done, the rubber was slipped on the arm and then pared down with a knife to about the diameter of the inside of the open ring-clamp. When the screw (*n*) was tightened, the camera was securely held in the correct position. It only remained to set the prism-chamber at right angles to the ring-clamp, and to place the square mirror-rod (*f*) into the hole made for its reception, so that the metal axis (*g*) upon which the mirror revolves was again in the horizontal position, and the apparatus was ready for use.

The box (*j*) seen at the right of the instrument carries a small drawing-board (*k*) on which the drawing-paper is fastened. This drawing-plane can be raised or lowered by using taller or shorter boxes, care being taken, however, that there is no variation in the height of the plane once it is fixed.

Since the iron ring that carries the thin board for holding the objects can also be raised or lowered, it will be seen at once that one can draw either at natural size, or, within limits, on a larger or smaller scale.

It may be added that distortion must be guarded against. This is best done by drawing two circles on separate pieces of paper, one to be placed on the object-holding board, the other on the drawing-board. The outer edge of the latter is then raised or lowered until the circle on it ceases to appear longitudinally elliptical, even to the slightest degree.

This contrivance having saved the writer immense labors, he trusts that others may be similarly benefited.

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NOTES AND BRIEF ARTICLES

Mr. Robert Hagelstein, an active member in the New York Microscopical Society and an enthusiastic student of slime-moulds, is spending a part of the winter in Porto Rico collecting and studying the Myxomycetes. He is also assisting in the preparation of manuscript on this group for "The Mycology of Porto Rico and the Virgin Islands," a part of which is now in type.

The following notice has recently been received from Mr. Elam Bartholomew: "WITH THE ISSUANCE OF CENTURY 35 THE PUBLICATION OF NORTH AMERICAN UREDINALES IS HEREWITH DISCONTINUED." Mr. Bartholomew has done a great service to mycology in the years he has devoted to this work and mycologists will doubtless regret that it is necessary for him at this time to discontinue this valuable series of exsiccati.

Dr. Béla Husz, a member of the staff of the Experiment Station for Plant Pathology at Budapest, has been granted a fellowship by the International Education Board of New York for the purpose of studying fungous diseases and disease resistance in the United States. Doctor Husz has worked several months at the Minnesota Agricultural Experiment Station and is now studying in the Office of Pathological Collections, Bureau of Plant Industry, U. S. Department of Agriculture, where he is investigating the life histories of fungi.

Dr. F. D. Kern of Pennsylvania State College and Acting Dean of Agriculture in Porto Rico, Carlos E. Chardon, Commissioner of Agriculture of Porto Rico, and Mr. Rafael A. Toro, Assistant Pathologist in the Insular Experiment Station, sailed early in March for Santo Domingo for a five or six weeks collecting trip. Their time will be devoted to a collection and study of the fungi of that island.

There are students of mycology in general and students of Myxomycetes in particular who look forward to the culture-method of research, as alone likely to afford a sound basis for a taxonomy, at once satisfactory and permanent as far as such things go. All students of the chlorophylless plants become more and more conscious how entirely artificial our present classifications in scores of cases really are.

It is therefore from this point of view significant to read a paper recently presented by F. X. Skupiénski before the Warsaw Académie des Sciences, under the title: "Sur le cycle évolutif chez une espéce de Myxomycéte Endosporée, *Didymium difforme* (Duby)."

By a very ingenious series of cultures Mr. Skupiénski shows that the species studied is in fact heterothallic since it offers two sorts of spores from which proceed two kinds of myxamibic gametes. The union of the latter affords a resting zygote, from which we have later on the usual rapidly developing multinuclear plasmodium.

Mr. Skupiénski used carrot infusion agar as culture medium. He succeeded in sowing single spores. These in due time afforded zoospores and myxamibes, no plasmodium: When the products of two monospermous cultures were brought together in a third tube, the plasmodia appeared and went on to fructification. THOMAS H. MACBRIDE.

A NEW ILLUSTRATED MONOGRAPH OF THE BOLETACEAE OF CENTRAL EUROPE

Recent numbers of the Zeitschrift für Pilzkunde announce the prospective appearance of a critical and elaborately illustrated monograph of the Boletaceae of central Europe under the authorship of Franz Kallenbach, of Darmstadt, Germany. The work is to be issued under the joint auspices of the Deutsche Gesellschaft für Pilzkunde, the Deutsche Botanische Gesellschaft, and the Deutscher Lehrerverein für Naturkunde. It is to appear in about twenty parts, each part to contain two colored plates (quarto size) with text of approximately four pages. The price per part, to subscribers, is four marks, to others, five marks. Subscriptions are received by the treasurer of the Deutsche

Gesellschaft für Pilzkunde, Fritz Quilling, 28 Dreieichstrasse, Frankfurt a/M., Süd, Germany. LOUIS C. C. KRIEGER.

FOURTH INTERNATIONAL BOTANICAL CONGRESS

Investigators and teachers in the plant sciences, representing all aspects of botany, plant chemistry, plant pathology, bacteriology, agronomy, and forestry, are invited to attend the International Congress of Plant Sciences to be held at Ithaca, New York, August 16–23, 1926. This invitation is extended to all countries of the world. This Congress offers the first opportunity ever arranged in the United States for a general conference of all those professionally engaged in plant work. It possesses the additional compelling interest accruing from unrestricted international representation.

The Congress will be divided into about one dozen sections, each section with an invitation program occupying about four morning sessions. In the section for Mycology there will be arranged in addition several afternoon field trips or fungus forays to nearby points where the fungus flora is especially rich, and time will be set aside for round table or informal discussions.

Although the Congress is not to provide an occasion for legislation on regulatory matters of international significance (such as nomenclatorial rules), the organizing committee has expressly provided that "adequate opportunity shall be accorded all sections for the *discussion* of regulatory recommendations of international significance," in order that a better understanding may be reached for definite action at a subsequent international congress.

Communications concerning the section for Mycology should be addressed to the Secretary for the section. H. M. FITZPATRICK.

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